DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the rotator of the rotating machine of a dynamo or an electric motor.
[0002]
[Description of the Prior Art]In the rotator of a rotating machine, it arranges radiately so that the same polarity may face the circumference of the axis of rotation in a permanent magnet, The crevice between permanent magnets is filled up with a magnetic material, it is considered as a pole section, and there is a thing of the structure which filled up the periphery [of a permanent magnet] and inner circumference side of this permanent magnet and this pole section with the nonmagnetic material, and was made into the nonmagnetic part (what is called IPM (Interrir Permanent Magnet) rotator of type). Drawing 5 is a figure showing such a conventional rotator. In drawing 5, a rotator and 2 for 1 a pole section and 3 a nonmagnetic part and 4 The axis of rotation, The numerals 5 shows a permanent magnet and L_1 and, as for L_2, the direction straight line of an outer peripheral shaft, X, and Y indicate a cross section position to be, The intersection of direction straight-line of outer peripheral shaft L_1, and a X-X section and a Y-Y section, P_{2X}, and P_{2Y} of P_{1X} and P_{1Y} are the intersections of direction straight-line of outer peripheral shaft L_2, and a X-X section and a Y-Y section. Drawing 5 (1) is the figure seen from the side, and drawing 5 (2) is the figure which cut and lacked a part of nonmagnetic part 3, and was seen from the side.
[0003]The pole section 2 laminates the thin board of a magnetic material (an example, a magnetic steel sheet), and is constituted. The nonmagnetic part 3 comprises non-magnetic metal material (an example, aluminum). The method of the composition is performed by crimping non-magnetic metal material by fusing and casting **** or non-magnetic metal material, after laminating a magnetic plate and incorporating a permanent magnet. Drawing 6 is a figure showing the X-X section of the rotator of drawing 5. Since the conventional rotator 1 is considered as the same composition in shaft orientations, the Y-Y section of it is the same as a X-X section. Therefore, only the X-X section is shown here. Numerals correspond to the thing of drawing 5 and 3A and 3B are nonmagnetic parts.
[0004]The nonmagnetic part 3A is a nonmagnetic part by the side of a periphery from the permanent magnet 5, and the nonmagnetic part 3B is a nonmagnetic part by the side of inner circumference from the permanent magnet 5. Both are connected via the end face of the shaft orientations of the rotator 1 so that I may be understood from drawing 5. The permanent magnet 5 is radiately arranged around the axis of rotation 4.
And he is trying for the same polarity to face each other.
Therefore, a n pole is made to be generated by the peripheral face (rotor surface) of the pole section 2 by which laminating formation is carried out to the crevice which the n pole and the n pole face, for example. The south pole is made to be generated by the peripheral face (rotor surface) of the pole section 2 by which similarly laminating formation is carried out to the crevice which the south pole and the south pole face.

[0005]Drawing 7 is a figure showing magnetic pole arrangement of the conventional rotator, and distribution of magnetic flux density. Numerals support the thing of drawing 5 and drawing 6. Drawing 7 (2) shows magnetic pole arrangement. However, the circular rotor surface is developed and shown in linear shape. Drawing 7 (1) is the magnetic flux density in the magnetic pole arrangement. The portion above the magnetic flux density 0 expresses the magnetic flux density of a n pole, and the lower portion expresses the magnetic flux density of the south pole. phi_M is the maximum of the magnetic flux density in this magnetic pole structure. Distribution of magnetic flux density is 0 (neutrality) right above the permanent magnet 5 so that it may illustrate. In the center portion which is magnetic flux density size and is most separated from the permanent magnet 5 of both sides in the portion near the permanent magnet 5 of both sides in the portion of S magnetic pole, it is low. In the center portion which is magnetic flux density size and is most separated from the permanent magnet 5 of both sides in the portion near the permanent magnet 5 of both sides similarly by the portion of N magnetic pole, it is low.
[0006]By the way, since point P_{1X} on direction straight-line of outer peripheral shaft L_1 is a point right above the permanent magnet 5, the magnetic flux density is 0. Since it is a point right above the point P_{1Y} mist beam permanent magnet 5, similarly the magnetic flux density is 0. Thus, since the internal structure of the rotator [directly under] 1 of it is the same, every point of magnetic flux density is the same, when it carries out by following direction straight-line of outer peripheral shaft L_1. Point P_{2X} of direction straight-line of outer peripheral shaft L_2 is a point right above the omitted portion of the adjoining permanent magnet 5, and the magnetic flux density presupposes that it is it phi_2. Since it is a point right above the omitted portion of the permanent magnet 5 which carries out point P_{2Y} mist beam contiguity, similarly the magnetic flux density is phi_2. The magnetic flux density of the point on direction straight-line of outer peripheral shaft L_2 is phi_2 at every point. Thus, in the conventional rotator 1, when it carried out by following each direction straight line of an outer peripheral shaft, every point of magnetic flux density was the same, but when the direction straight lines of an outer peripheral shaft differed, magnetic flux density had become a different value.
[0007]
[Problem(s) to be Solved by the Invention](Problem) In the above mentioned conventional rotator, the cogging phenomenon occurred and there was a problem that rotation did not become smooth.
(Explanation of a problem) As shown in drawing 7 (1), near the permanent magnet, the magnetic flux density on the pole face is large, and fairly small by the omitted portion of both disconnected also from the adjoining permanent magnet compared with it. Therefore, when the rotation angle position of the rotator was different, the magnetic attraction power committed between stators changed a lot, and the cogging phenomenon that rotation was not performed smoothly had arisen. This invention makes it a technical problem to solve the above problems.
[0008]
[Means for Solving the Problem]In order to solve said technical problem, by this invention, it arranges radiately so that the same polarity may face the circumference of the axis of rotation in a permanent magnet, Suppose that it allocates so that said permanent magnet may incline in a hoop direction to shaft orientations of said rotator in a rotator of a rotating machine which buried a crevice between these

permanent magnets by a magnetic material, considered it as a pole section, filled up the periphery [of this permanent magnet], and inner circumference side of this permanent magnet and this pole section with a nonmagnetic material, and was constituted as a nonmagnetic part. The aforementioned pole section may laminate and constitute a magnetic plate, and can also constitute it with a magnetic material of one. A permanent magnet allocated in one place may be made to comprise two or more split magnets.
[0009](Outline of operation to solve) Since a hoop direction was made to incline to shaft orientations of a rotator and a permanent magnet was allocated, it is lost that average value of magnetic flux density changes greatly with angular positions of a rotator. The almost same running torque is made to arise and a cogging phenomenon stops therefore, arising in no rotation angle position.
[0010]
[Embodiment of the Invention]Hereafter, the embodiment of this invention is described in detail based on a drawing. Drawing 1 is a figure showing the rotator of this invention. The numerals with which numerals correspond to the thing of drawing 5 and A, B, and C indicate a cross section position to be, L_3, and L_4 are the direction straight lines of an outer peripheral shaft, P_{3A}, P_{3B}, and P_{3C} The intersection of direction straight-line of outer peripheral shaft L_3, and an A-A section, a B-B section and a C-C section, P_{4A}, P_{4B}, and P_{4C} are the intersections of direction straight-line of outer peripheral shaft L_4, and an A-A section, a B-B section and a C-C section. Constitutionally, the point which is different from the conventional example of drawing 5 is a point that the pole section 2 and the nonmagnetic part 3 are inclined and formed in the hoop direction to shaft orientations. When it inclines, and the periphery of a rotator is followed to shaft orientations and it goes, even if the reason to establish follows which direction straight line of an outer peripheral shaft and it performs it (for example, even if it carries out by following direction straight-line of outer peripheral shaft L_3) Even if it carries out by following L_4, when magnetic flux density is averaged in shaft orientations, it is for making it become the almost same value.
[0011]Drawing 4 is a figure showing magnetic pole arrangement in the section A, B, and C of the rotator of this invention, and distribution of magnetic flux density, and numerals support the thing of drawing 7 and drawing 1. As for the thing of A section, and drawing 4 (2), the thing of B section and drawing 4 (3) of drawing 4 (1) are the things of C section. Since the permanent magnet 5 is inclined and formed in the hoop direction to shaft orientations if direction straight-line of outer peripheral shaft L_3 is made into the direction straight line of an outer peripheral shaft which passes along point P_{3A} of the center right above the permanent magnet 5 by A section, As for intersection P_{3B} of it, and B section and C section, and P_{3C}, the point right above the permanent magnet 5 does not become (it has shifted according to the degree of an inclination). Therefore, the magnetic flux density in each point also becomes a different thing like -ϕ_{3C} by -ϕ_{3B} and point P_{3C} by point P_{3A} at 0 and point P_{3B} so that it may illustrate. And the magnetic flux density covering the whole direction straight-line of outer peripheral shaft L_3 becomes what averaged such magnetic flux density about the point on direction straight-line of outer peripheral shaft L_3.
[0012]Since the permanent magnet 5 is inclined and formed in the hoop direction to shaft orientations if it is the direction straight line of an outer peripheral shaft which passes along point P_{4A} right above the

omitted portion of the permanent magnet 5 which adjoins direction straight-line of outer peripheral shaft L_4 in A section, The point right above the omitted portion of the permanent magnet 5 that intersection P_{4B} of it, and B section and C section and P_{4C} adjoin does not become. Therefore, the magnetic flux density of point P_{4A} on direction straight-line of outer peripheral shaft L_4, P_{4B}, and P_{4C} does not become the same like the case of direction straight-line of outer peripheral shaft L_3. The same may be said of other direction straight lines of an outer peripheral shaft. and the averaged above magnetic flux densities covering each direction straight line of an outer peripheral shaft -- inclination allocation of a permanent magnet etc. -- abbreviated -- since it is the same, it is almost lost with the rotation angle position of a rotator that it is large or small. It becomes smooth [rotation] and stops therefore, almost producing a cogging phenomenon. Drawing 1 of a slope direction is good also as an opposite direction (that is, although it should incline in the upward slant to the right in drawing 1, the lower right may make ** incline). It is preferred for the gap of the left end of the permanent magnet 5 and right end by an inclination to make it comparable as the interval of the coil slot of the stator (not shown) which has countered the rotator 1.

[0013]Next, how to manufacture the rotator of this invention of structure which was described above is explained. The 1st methods include the following.

** Laminate the magnetic steel sheet which forms the pole section 2, and insert a permanent magnet in shaft orientations (this is the same as the former).

** Shift a magnetic steel sheet so that a permanent magnet may incline in a hoop direction to shaft orientations in the state (each sheet [every / with a thin magnetic steel sheet] shifts little by little.).

** The periphery side of a permanent magnet casts the non-magnetic metal material (an example, aluminum) fused to the inner circumference side of a magnetic steel sheet and a permanent magnet.

[0014]The 2nd methods include the following.

** Laminate a magnetic steel sheet and make a hoop direction incline to shaft orientations using a jig.

** Insert a permanent magnet in the hole which should insert a permanent magnet.

** The periphery side of a permanent magnet casts the non-magnetic metal material fused to the inner circumference side of a magnetic steel sheet and a permanent magnet.

[0015]by the way -- since each sheet metal of a magnetic steel sheet is shifted by the hoop direction one by one -- the all same as a magnetic steel sheet as usual, supposing it uses the thing of identical shape, The hole where the hole which connects the mouth for permanent magnet insertion of the laminated magnetic steel sheet of one end of shaft orientations and the mouth for permanent magnet insertion of the end of another side is connected linearly does not become. It becomes a hole connected [the cylindrical surface] by carrying out so that it may surge aslant. Therefore, it is necessary to also make shape of the permanent magnet inserted in it into the thing of the shape which can be inserted in the winding hole.

[0016]If I hear that he would like to use having used it conventionally and a same-shaped thing (thing of rectangular parallelepiped shape) as a permanent magnet and it is, it is necessary to consider that the hole for permanent magnet insertion made in a magnetic steel sheet negates the above-mentioned wave, and to make it. That is, when piercing and forming a magnetic steel sheet, it is made for the permanent magnet insertion hole done when the punching position of the hole for permanent magnet insertion is changed little by little, is laminated according to the lamination station of the magnetic steel sheet and

only a necessary angle is made to incline in shaft orientations to turn into a linear hole. However, it does not bear changing a punching position for every magnetic steel sheet in this way etc. complicated, but a manufacturing cost also becomes large. What is necessary is just to make oversized a little permanent magnet insertion hole, if it is going to make it pierce and form every magnetic steel sheet in the same shape in order to make small cost in a magnetic steel sheet punching process. Then, it is because the size of a hole has a margin even if it becomes the hole where the permanent magnet insertion hole surged, so the permanent magnet of rectangular parallelepiped shape can be inserted.
[0017]Drawing 2 is a figure showing one example of the permanent magnet 5 used by this invention. As for a top view and drawing 2 (2), a front view and drawing 2 (3) of drawing 2 (1) are side views, and, as for the upper surface and 5-2, the left end neighborhood and 5-4 are right end neighborhoods the undersurface and 5-3 5-1. As shown in a front view, the upper surface 5-1 and the undersurface 5-2 are made into shape which curves up for a while. By making this correspond to the above mentioned wave, and making it curve in this way, The existence position (distributed situation) of the permanent magnet 5 radially seen from the shaft center of the rotator can be made as equivalent as possible (supposing it puts the permanent magnet of rectangular parallelepiped shape on a cylindrical surface aslant [shaft-orientations]). Although the portion which is in contact with the cylindrical surface exists in the position which separated only the cylinder radius from the cylinder center, the portion which has not touched will exist in a position further than this radius. If it is made to curve like drawing 2, it can exist in the position almost more nearly same than a cylinder center. . As shown in the top view of drawing 2 (1), when using the left end neighborhood 5-3 and the right end neighborhood 5-4 as the slanting neighborhood, making it the parallelogram as a whole according to the direction made to incline and the permanent magnet 5 is allocated in the arranging position of drawing 1 (2), the both ends of the permanent magnet 5 can be made parallel with the end face of the rotator 1.
[0018]Drawing 3 is a figure showing other examples of the permanent magnet 5 used by this invention. In drawing 3, 5-5,5-6 is an inclination cut face and 5A-5F are split magnets. Drawing 3 (1) shows what cut suitably the portion which serves as the angle (corner) in the field of rectangular directions to the path of insertion to a permanent magnet insertion hole, and was made into the inclined plane. In the illustrated example, two angles, an upper right angle and an upper left angle, are cut, and it is being referred to as inclination cut face 5-5,5-6. It will become easy to insert in the hole for permanent magnet insertion if it does in this way. If needed, the number of the angles to cut is good also as three, and can also be set to four.
[0019]Drawing 3 (2) is divided into three, the upper inside and the bottom, in the path of insertion, and is taken as the split magnets 5A-5C. Drawing 3 (3) is divided into three to the path of insertion in rectangular directions, and is taken as the split magnets 5A-5C. The number of partitions is good as for two, and can also be made into four or more than it. If it divides in this way, since it can shift little by little and can be settled, it will become easy to insert in the hole for permanent magnet insertion too. Although the pole section 2 presupposed that a thin magnetic steel sheet is laminated and constituted in the aforementioned embodiment, the size of the rotator 1, etc. can constitute from the magnetic material of one. This invention can be applied not only to the rotator of the above mentioned type but to a thing various type.
[0020]
[Effect of the Invention]Since according to the rotator of the rotating machine of this invention the hoop

direction was made to incline to the shaft orientations of a rotator and the permanent magnet was allocated as stated above, it is lost that the average value of magnetic flux density changes greatly with angular positions of a rotator. Therefore, the almost same running torque is made to arise and it can be made not to produce a cogging phenomenon in every rotation angle position.